

BALDWIN



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BALDWIN DIESEL-ELECTRICS

**OPERATING INSTRUCTIONS
FOR
SWITCHING LOCOMOTIVES**

**THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA**

The Baldwin Diesel Electric Switching Locomotive is the product of modern engineering and production methods superimposed upon the locomotive experience of more than a century.

Proper operation, as outlined in this booklet, coupled with adequate inspection and maintenance, will provide high efficiency, low-cost motive power.

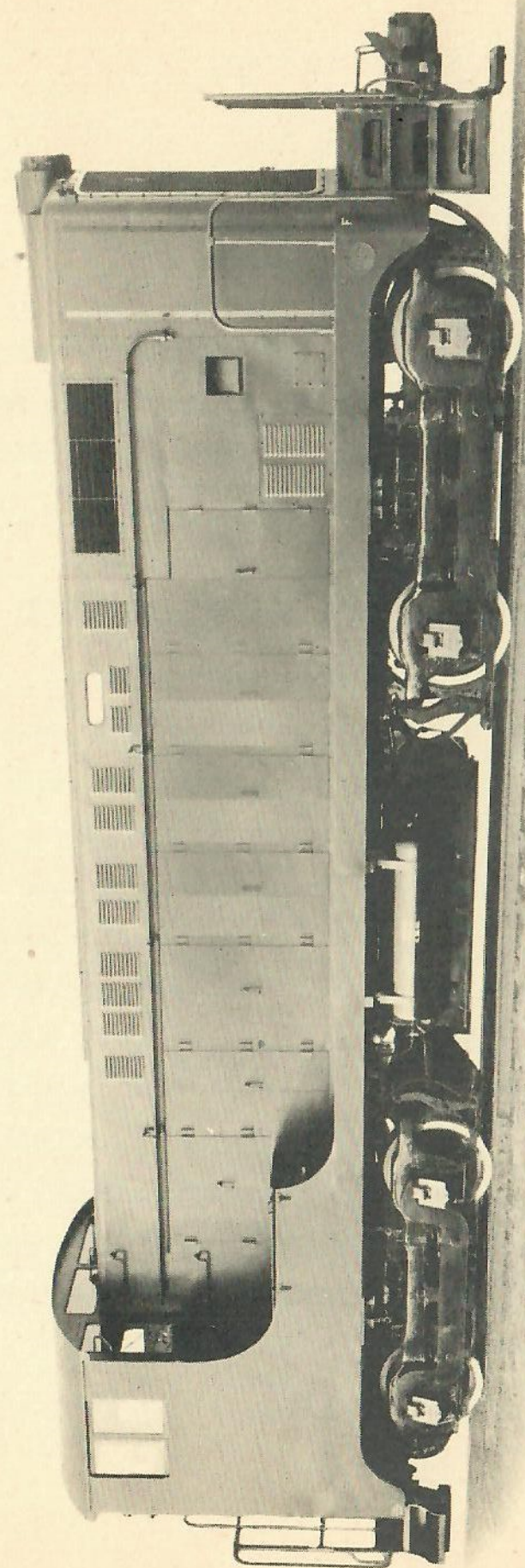


PLATE 1

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LOCOMOTIVE OPERATION

The location of all switches, valves and fuses mentioned in connection with locomotive operation can be determined by reference to Plate 3, excepting where a different plate number is given.

I. PRELIMINARY:

- A. Light cab by closing switch on control stand.
- B. Close battery cut-out switch in equipment cabinet. (See Plate 4)

II. TO LIGHT LAMPS:

Any of the locomotive lamps may be lighted by closing the corresponding switch on control stand.

The gauge and meter button includes in its circuit the number lights and the classification lights. The cab light button includes in its circuit the electric equipment cabinet light, which has an individual cut-off switch at the light.

III. TO START DIESEL ENGINE:

- A. Move speed lever to "idle" position.
- B. Insert handle in reverser and leave in "off" position.
- C. Close control switch. This will start fuel transfer pump. Pressure will be indicated on fuel oil pressure gauge. Should gauge fail to indicate pressure, check:
 - 1. Fuel supply gauge. (See Plate 9)
 - 2. Emergency stop valve. Reset if tripped. (See Plate 9)
- D. Press engine starting button on control stand. (This is a spring return button, and must be held closed.) Contactors G-1 and G-2, located in electric equipment cabinet, will close. This will connect the generator across the battery, starting the engine. Should engine fail to turn, examine the control and lighting circuit fuse in electric equipment cabinet. (See Plate 4)
- E. When engine fires, and lubricating oil pressure rises to 10 pounds, release the engine starting button. This will disconnect the generator from

the battery. If engine turns, but does not fire, check overspeed stop (See Plate 8) and reset if necessary.

- F. Check lubricating oil pressure gauge. Pressure should be between 30 and 80 pounds.

IV. TO CHARGE BATTERY WHILE DIESEL ENGINE IS IDLING:

- A. Operate exciter switch on control stand. The auxiliary generator will then begin to charge the storage battery. The charging rate will be indicated on the battery charging ammeter (See Plate 3), and should range between 5 and 28 amperes.

V. TO PUMP AIR:

- A. As engine runs, the mechanically driven compressor will pump air into the main reservoir. Be sure that indicator on the main reservoir air pressure gauge rises to the correct point and then stops.
- B. Check control air pressure gauge. (See Plate 4) A pressure of 70 pounds should be indicated.
- C. Drain both main air reservoirs once each 8 hours. (Located under running boards)
- D. Note that compressor resumes pumping air when reservoir pressure drops to lower governor setting.

VI. TO START LOCOMOTIVE:

- A. Place the reverse lever in the forward or reverse position, according to the direction in which the locomotive is to be moved.
- B. Move the speed lever slowly from the "idle" position until a current flow from the generator to the traction motors is indicated on the load ammeter. If the train is not heavy nor the grade severe, the locomotive will move.
- C. Move the speed lever slowly toward the full speed position. If the locomotive is moving, the speed will increase. If locomotive does not move and load ammeter registers:
 - 1. RETURN THROTTLE TO "IDLE" POSITION.
(BE SURE THIS IS DONE BEFORE PROCEEDING FURTHER.)

2. Make sure exciter switch is closed.
 3. Make sure motor cut out switches in control cabinet are closed. (See Plate 4)
- D. The speed lever should be moved slowly to prevent spinning the wheels. Should the wheels spin, return the throttle toward the "idle" position until the spinning stops. Slow acceleration may then be resumed. Wheel slippage is indicated by pulsation of the load ammeter hand.
 - E. To attain full locomotive speed, move speed lever to the "full speed" position.

VII. OPERATION WITH TRACTION MOTOR FIELDS SHUNTED:

With a light train, the locomotive will operate at higher speeds with the traction motor fields shunted. This shunting operation is automatic.

VIII. PERMISSIBLE AMPERAGE:

The temperature of the insulation in the generator and in the traction motors limit the load that can safely be moved by the locomotive. This temperature depends upon several factors: the temperature of the outside air, the amount of current flowing from the generator to the traction motors, and the length of time the current is permitted to flow.

(IMPORTANT! OVERLOADING MAY RESULT IN SERIOUS DAMAGE TO THE GENERATOR AND TRACTION MOTORS!)

The following table shows the amount of current and the time limits over which it may be permitted to flow:

1000 H. P.	
TIME	AMPS.
Continuous	1060
40 minutes	1200
20 minutes	1350
15 minutes	1400
5 minutes	2000

IX. TO OPERATE SANDERS:

When there is danger of slipping the wheels in a heavy start, sand can be applied by operation of the sander valve, located on the brake pedestal.

X. TO STOP THE LOCOMOTIVE:

Move the speed lever to the "idle" position. This will stop the current flow from the generator to the traction motors. The locomotive can then be brought to a full stop by brake application.

XI. TO STOP THE LOCOMOTIVE IN AN EMERGENCY:

Open the control switch and apply the brakes. This will also stop the Diesel engine. (Return the speed lever to the "idle" position before preparing for resumption of operation.)

XII. TO SHUT OFF FUEL OIL IN AN EMERGENCY:

When in cab, pull the RED emergency handle located in right rear corner. (See Plate 6)

When outside cab, pull the emergency stop located on right side over No. 2 truck.

XIII. TO SHUT DOWN DIESEL ENGINE:

A. Idle engine until cooling water temperature has dropped to approximately 130° F.

B. With speed handle in the "idle" position, move reverser handle to the "off" position.

C. Open control switch.

XIV. DIESEL ENGINE COOLING SYSTEM:

The level of the cooling water must be maintained above the "low" level.

Cooling water temperature may vary between 140° F. and 180° F., depending on atmospheric temperature and engine load. On long transfer runs the cooling water temperature may rise to 180° F. with safety, but care must be taken in cooling the engine to the ideal operating temperature range after such operation.

XV. DIESEL ENGINE TEMPERATURE CONTROL:

Two devices are provided to control the water temperature. They are the radiator and the cooling fan. The radiator action is controlled by air-operated shutters. The cooling fan is engaged by an air-operated clutch. Control valves for both devices are located on the control stand. See Plate 3)

Under certain operating conditions it is possible to maintain the correct temperature range by operation of the radiator shutters alone. When the fan must be employed to supplement the cooling action of the radiator, the clutch should be engaged continuously. The correct temperature range should then be maintained by adjustment of the radiator shutters. (Unnecessary use of the clutch will result in loss of horsepower, undue wearing of clutch parts, and rapid and wide variations in water temperature.) The engine should be running at idling speed when clutch is first engaged.

If the cooling water temperature rises above 180° F. with shutters open and fan operating, run Diesel engine at reduced speed. Then if temperature does not drop, stop the locomotive, idle the Diesel engine, and determine the cause of the overheating. (On long runs in extremely hot weather of 105° F. or more, this procedure should be followed if cooling water temperature exceeds 190° F.)

XVI. TO TAKE A TRACTION MOTOR OUT OF SERVICE:

If a failure occurs in either No. 1 or No. 3 traction motor, cut both out of service by opening No. 1 motor cut out switch in the equipment cabinet. (See Plate 4)

If the failure occurs in either No. 2 or No. 4 traction motor, cut both out of service by opening No. 2 motor cut out switch, at the same location.

(WARNING! BEFORE OPENING EITHER CUT OUT SWITCH MAKE SURE THE SPEED HANDLE IS IN THE "IDLE" POSITION AND REVERSE LEVER IS IN THE "OFF" POSITION!)

XVII. TO RERAIL LOCOMOTIVE:

Serious damage to traction motors may result from spinning wheels. Therefore, it is NOT advisable to attempt to rerail a locomotive under its own power.

However, if ONE pair of wheels ONLY is derailed, it is possible to rerail the locomotive by cutting out the motor driving the derailed wheels as explained in paragraph XVI above, and utilizing the remaining motors for tractive effort.

XVIII. TO TAKE LOCOMOTIVE OUT OF SERVICE:

- A. Shut down Diesel engine as described in Paragraph XIII.
- B. Open battery cut out switch in equipment cabinet. (See Plate 4)
- C. Apply hand brake. (See Plate 6)

XIX. CARBONSTAT AND LOAD REGULATING VALVE:

The purpose of the Carbonstat is to automatically provide full load output of the Diesel Engine to the Generator under varying temperature conditions. The Carbonstat and Regulating Valve should require no attention other than periodic examinations for loose connections and leaks. (See Plate 5)

LOCATION OF CONTROLS, GAUGES AND INSTRUMENTS

FUSES:	PLATE
Auxiliary Circuit-Battery Charging	4
Control	4
Light	4
GAUGES:	
Air Brake Pressure	3
Control Air	4
Fuel Oil Pressure	3
Fuel Tank	9
Lubricating Oil Bayonet	8
Lubricating Oil Pressure	3
Water Tank	7
Water Temperature	3
METERS:	
Battery Charging Ammeter	3
Main Generator Ammeter	3
LEVERS:	
Reverser	3
Speed Handle (Throttle)	3
SWITCHES:	
Battery	4
Cab Light	3
Control	3
Electric Equipment Cabinet Light	3
Engine Starting	3
Exciter	3
Gauge, Number Plate, Order and Classification Lights	3
Headlight Control	3
Headlight Dimmer	7
Heater	3
Hood Light	3
Motor Cut-out	4

VALVES:**PLATE**

Air Brake Reducing and Feed	4
Air Brake Cut-out	3
Air Brake Operating	3
Bell Ringer (Engineman's)	3
Bell Ringer (Helper's)	7
Control Air Reducing	4
Fuel Oil Emergency Cut-out	9
Horn Operating	3
Radiator Fan Clutch Operating	3
Radiator Shutter Operating	3
Sander Operating	3
Whistle Cut-out	3
Window Wiper	6, 7

MISCELLANEOUS:

Emergency Fuel Cut-out Trips	6
Fire Extinguisher	6
Hand Brake	6
Carbonstat and Load Regulating Valve	5

QUESTIONS AND ANSWERS

LOCOMOTIVE OPERATION:

- Q. Regardless of the completeness of the system of maintenance and inspection existing on the locomotive, what inspections should be made by the Engineman before starting work with the locomotive?
- A. Check the following:
Supply of fuel, water, oil and sand. Engine oil, air and fuel pressures. Test automatic and independent air.
- Q. How is the locomotive started? Train speed increased? Decreased? Engine speed regulated?
- A. The locomotive is started by moving the "reverse" lever on the control stand to either "forward" or "reverse" position as desired, releasing the brake and moving throttle handle out slowly. Train speed is increased by moving throttle handle away from the idle position toward the full open position, and is decreased by reversing this operation. The engine speed is at all times under control of the engine governor.
- Q. What is the last thing that an engineman should do before leaving the locomotive at the completion of his run when locomotive is not to be moved immediately under its own power?
- A. The hand brakes should be set. All switches should be opened, including all lights and the main battery switch.
- Q. What should be done if there is a possibility of locomotive being handled by other power, such as switch engine, or being towed in train?
- A. Open main battery switch in electrical equipment cabinet (See Plate 4); close double head cut-out cock in brake system located on brake pedestal. Place automatic air handle in running position.
- Q. What may cause air compressor failure?
- A. Internal trouble in the compressor. Sticking valves. Air compressor governor failure. Broken coupling.
- Q. When should sand be used? Is sand harmful to the equipment? Why?

- A. Sand should be used only when necessary. Excessive use of sand at any time may be harmful insofar as this increases the possibility of dust being drawn into ventilating air supplied to the traction motors. The abrasive action of sand is highly detrimental to the commutators and brushes of the traction motors.

ENGINE OPERATION

- Q. Describe how the engine should be started after standing inoperative for several hours.
- A. Close main battery switch. See that everything is clear in the engine room. Close control switch. Place reverser handle in center position and move throttle to idle position. Press engine starting button.
- Q. If engine rotates, but does not fire, how should one proceed to determine the trouble?
- A. Check overspeed stop and reset, if necessary. (See Plate 8) See that a sufficient supply of fuel is in locomotive fuel tank. See that control switch is "in", that fuel pump is running and a pressure of at least 10 lbs. per sq. in. is indicated by the white hand on the duplex fuel pressure gauge on instrument panel on control stand. Be certain that fuel is reaching the injectors. Be certain throttle handle is in "idle" position.
- Q. After engine has started, what precautions should engineer take?
- A. Be sure that engine lubricating oil pressure rises to minimum of 30 lbs. per sq. in. If no pressure shows on the gauge, stop engine immediately. Be certain that engine cooling water is circulating properly. Do not attempt to load engine by moving train until the engine has been thoroughly warmed up and the water temperature has reached 125°F. Before attempting to move locomotive close exciter field switch on control stand.
- Q. What precautions should be taken in stopping engine?
- A. When stopping the engine it should first be slowed to idling speed and operated at this speed until temperature of cooling water decreases to 130°F. maximum.
- Q. How is the engine stopped?
- A. The engine will stop when the control switch is moved to the "off" position.

- Q. How is the movement of the throttle transmitted to the fuel injectors?
- A. Movement of the throttle is transmitted through air valves and piping to the governor. The governor then controls the injection pump control shaft, which transmits movement to the injector fuel control racks. These, in turn, permit fuel to flow to the fuel injectors.
- Q. Explain the action of the governor.
- A. The governor consists of three parts: a speed measuring device; a relay which varies the supply of fuel as required to carry the load applied to the engine; and a stabilizer which guards against excessive governor "hunting" action.
- Q. What is the maximum speed engine should be run to pump air, when locomotive is standing.
- A. Throttle handle open about $\frac{3}{4}$ on the quadrant.
- Q. What is the reason for carrying a bar or lever on the locomotive which can be used for slowly turning the engine over by hand and what precautions must be observed when it is used?
- A. This bar or lever is used in "turning the engine over" when checking and adjusting valves and injector timing. Care should be taken in using this bar to prevent injury due to "back-kick" resulting from engine compression. Extreme care should always be taken to REMOVE THIS BAR BEFORE STARTING THE ENGINE. Open cylinder head indicator cocks before barring over engine. These must be closed when engine is started. CONTROL SWITCH SHOULD BE KEPT IN "OFF" POSITION WHEN BAR IS IN USE.

LUBRICATING OIL SYSTEM

- Q. How much oil should be carried in the engine lubricating system? How low can the level go in emergencies?
- A. The crankcase should be filled to the "full" mark on the bayonet gauge. To fill with lubricating oil, first pour 10 gallons into the camshaft trough. Then pour 95 gallons into the crankcase. The engine can be operated with safety when oil level is at the "low" mark.

- Q. What should be checked if oil pressure does not build up to proper pressure after engine is started?
- A. Check to determine oil level in crankcase. If satisfactory examine for pipe leakage. If weather is excessively warm and oil is thin the bypass relief valve may need adjusting by maintainer to obtain proper pressure.

FUEL OIL SYSTEM

- Q. When should fuel oil filter cartridges be removed?
- A. They should be removed about every thirty days, or more frequently if the fuel oil is dirty.
- Q. Describe how the fuel used is delivered from the tanks under the locomotive to the fuel pumps on the engine.
- A. The fuel oil is taken from the tank under the frame by means of a motor driven pump, through the strainer located adjacent to the pump on the engine, thence forced through filters mounted on the engine, thence to a manifold mounted on the right side of the engine, through which it is fed to each injection pump, mounted on the individual cylinder, thence to the injection nozzle in the cylinder head.
- Q. If fuel should not get to the injector, what trouble should be looked for?
- A. See that there is sufficient fuel in the tanks. See that the fuel pump is running and fuel pressure is up. Check fuses. Check to see if the lines are leaking air or fuel. Check oil filters and strainers. Check low lubricating oil pressure shut down switch, hydraulic valve, and cylinder. Check to see if emergency fuel valve is tripped. Check overspeed stop.
- Q. How is fuel supply shut off in case of accident or fire?
- A. Fuel supply is shut off by pulling either the emergency fuel cut-off pull ring located under the cab skirt at right side back end, or the handle painted RED in corner of operating cab on engineman's side.

COOLING SYSTEM

- Q. How is the engine cooling system filled?

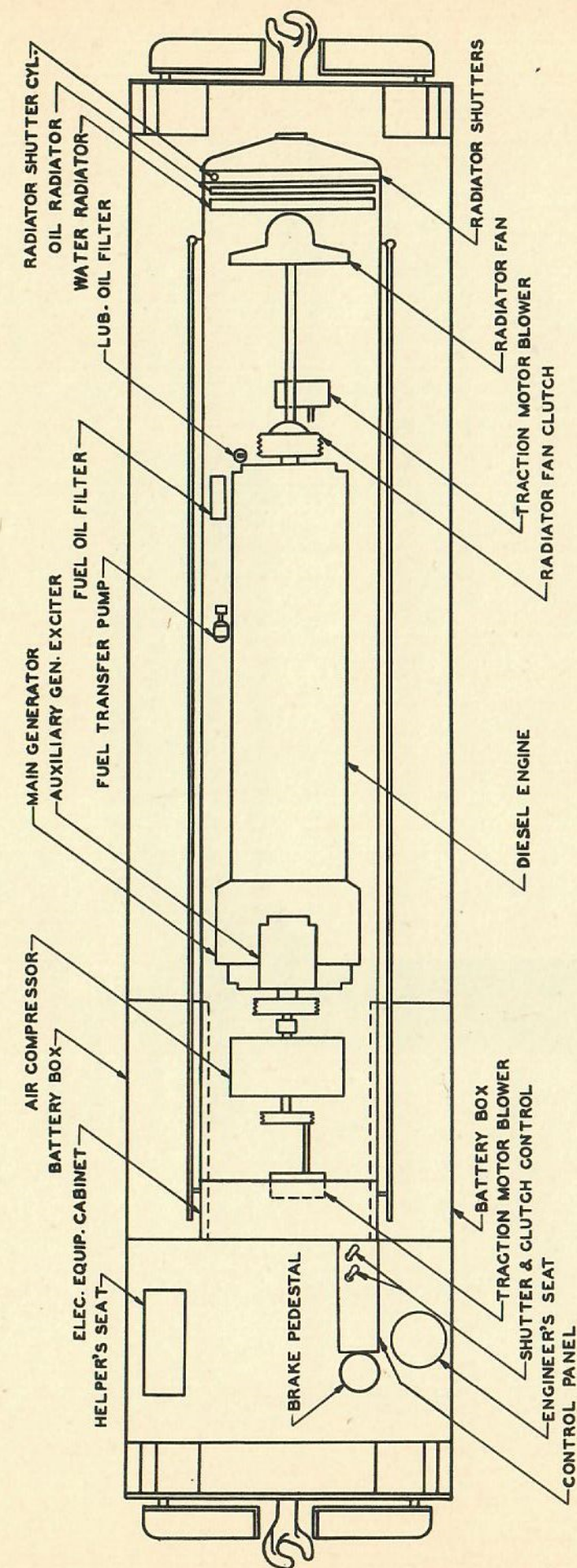
- A. The engine cooling system is filled through the filler pipe along left side of cab skirt near front end. Valve with extension handle is on left side near traction motor blower (See Plate 9). The system can, in emergency, be filled through filler on roof near front end. Filling through roof filler is not recommended as cooling system may become air-bound.
- Q. How much water should be carried in the engine cooling system?
- A. Fill until overflow from stand pipe appears. Approximately 290 gallons of water are required.
- Q. How can it be determined if water is circulating properly?
- A. The engine water distant reading thermometer in cab provides an excellent means of showing a faulty water circulation or lack of water. Abnormally high temperature as indicated by this thermometer is traceable either to faulty water circulation or lack of water in tank. Poor water circulation is also indicated by excessive localized heating at various points in the cooling system; for instance, cylinder heads, radiators or water pump. This may be determined by holding hand at various points in question and making comparison in degree of heat at the various places.
- Q. What is the proper range of operating temperatures for the cooling water?
- A. 140°F.—180°F. Endeavor to maintain at 160°F.—170°F. However, on long transfer runs in extremely hot weather (105°F. and above) temperature of cooling water may rise to 190°F. but care must be used in cooling engine to desired operating temperature after the above operation.
- Q. How is the water temperature controlled?
- A. By air operated shutters and a cooling fan with air operated clutch. Engine speed should be reduced to idling before engaging clutch.
- Q. What may cause radiator fans to operate improperly?
- A. V-belts broken or too loose, defective clutch, loss of air.

- Q. If engine should overheat on account of insufficient water in cooling system, what should be done?
- A. The engine should be allowed to idle and hot water, if possible, should be added. If it is necessary to add cold water, it should be added VERY slowly.

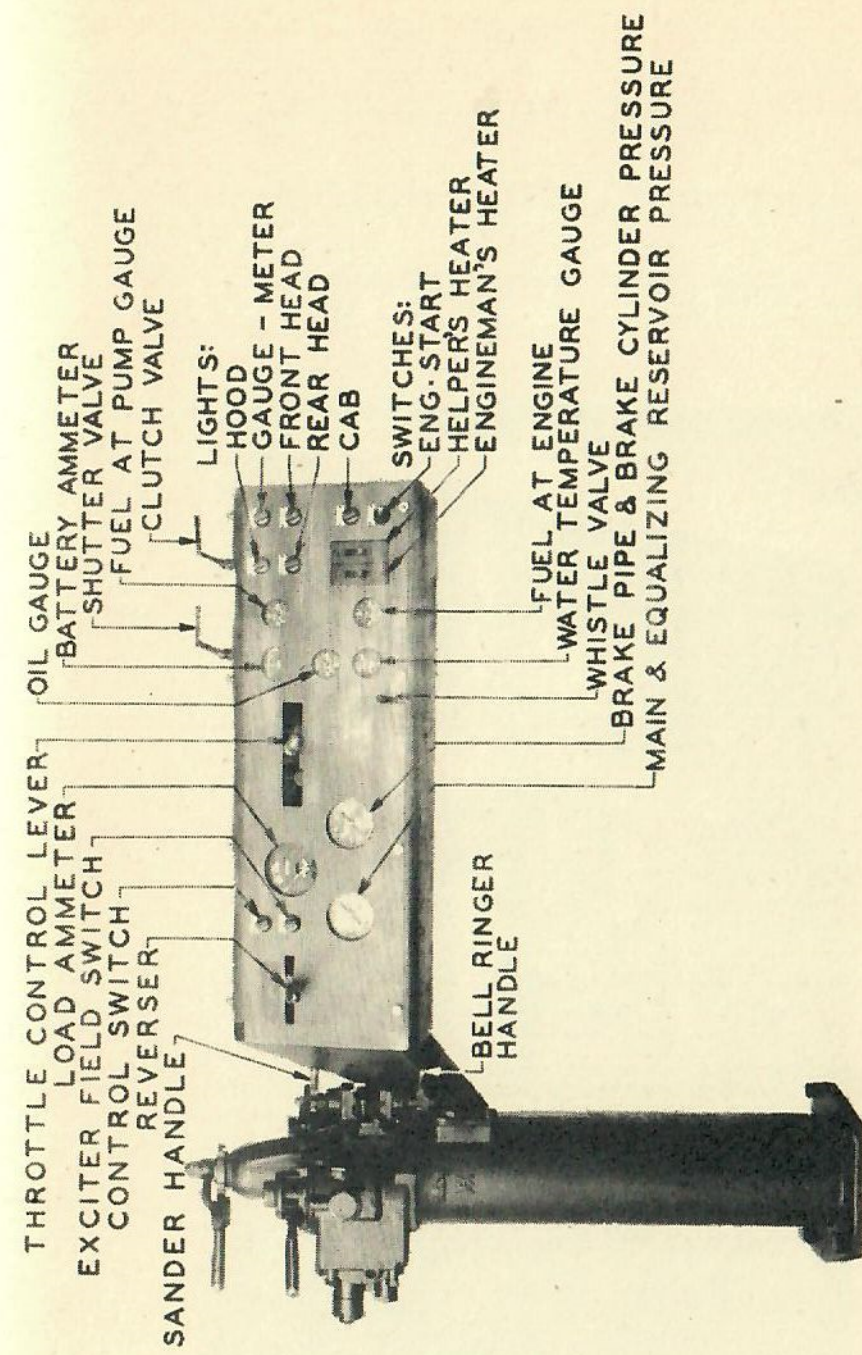
ELECTRICAL SYSTEM

- Q. What is the auxiliary generator voltage on this locomotive?
- A. 125 volts approximately for 56 cells of lead storage battery. (Headlights operate on a 32 volt circuit.)
- Q. How can it be determined when a traction motor is damaged, burned out, or short circuited?
- A. Lack of power, jerking, or a burning smell can be detected.
- Q. How are traction motors cut out?
- A. By opening motor cut out switches in electrical equipment cabinet. Switch marked No. 1 controls motors 1 and 3, and switch marked No. 2, motors 2 and 4.
- Q. How should locomotive be operated with motors cut out? At what speed?
- A. When motor is cut out, handle throttle with extreme care. Do not pull loads. Locomotive should be operated at very low speed.
- Q. Should the reverser handle be in any position other than that of the locomotive direction?
- A. No. At no time should the reverser handle be shifted until the locomotive has come to a COMPLETE stop. Handle to be in center position when stopped or idling for a long period of time.
- Q. What is the purpose of the reverse current relay.
- A. To connect the auxiliary generator to the battery for charging, and to prevent the battery from feeding back into the auxiliary generator if the generator voltage falls below battery voltage.

- Q. Explain the manner in which engine is started by the battery.
- A. It is merely a case of using the generator temporarily as a series wound motor with the locomotive storage battery furnishing the required energy.
- Q. What grade of oil should be used in axle bearings?
- A. Use Baldwin Oil "R". Unless the climate is very uniform throughout the year, two grades of oil are recommended, one for summer and a lighter oil for winter.
- Q. Explain what should be done in case a traction motor axle bearing runs excessively hot; and when it continues to run hot.
- A. Check oil level, adding oil if necessary at the oil well, and also pouring considerable oil directly on top of the waste. Work waste about and over against the axle. If bearing continues to run hot, insert shims under bearing cap so clamping effect on axle will be removed. See that packing is in good condition and not charred or glazed.



GENERAL ARRANGEMENT



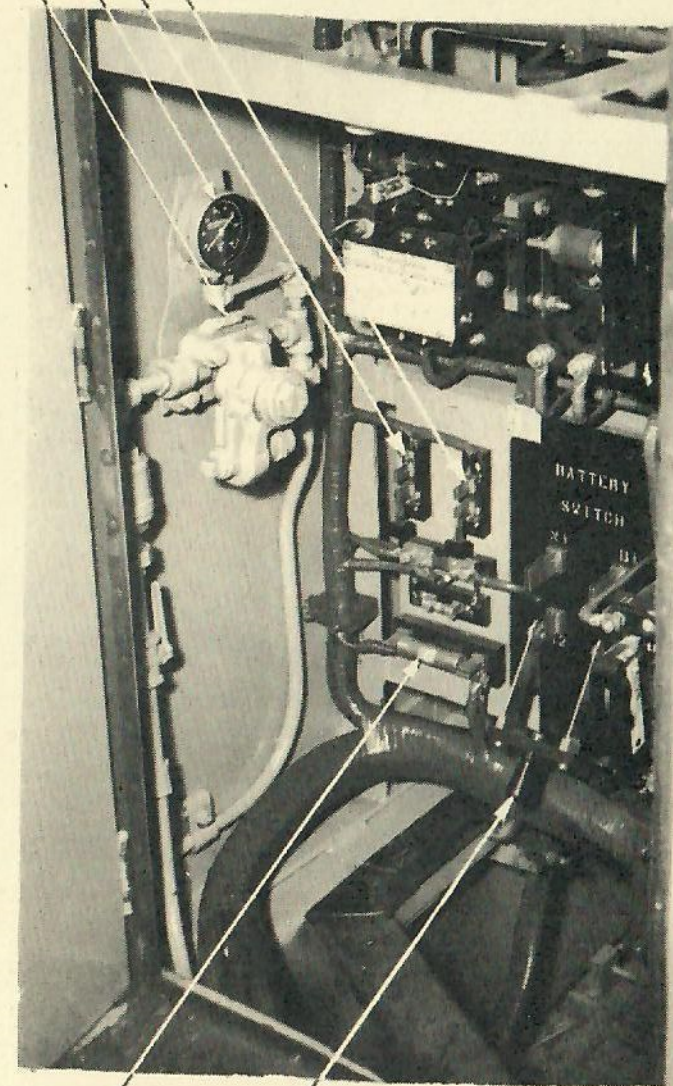
BRAKE PEDESTAL AND CONTROL PANEL

REDUCING VALVE

CONTROL AIR GAUGE

MOTOR CUTOUT SWITCH NO. 1

MOTOR CUTOUT SWITCH NO. 2



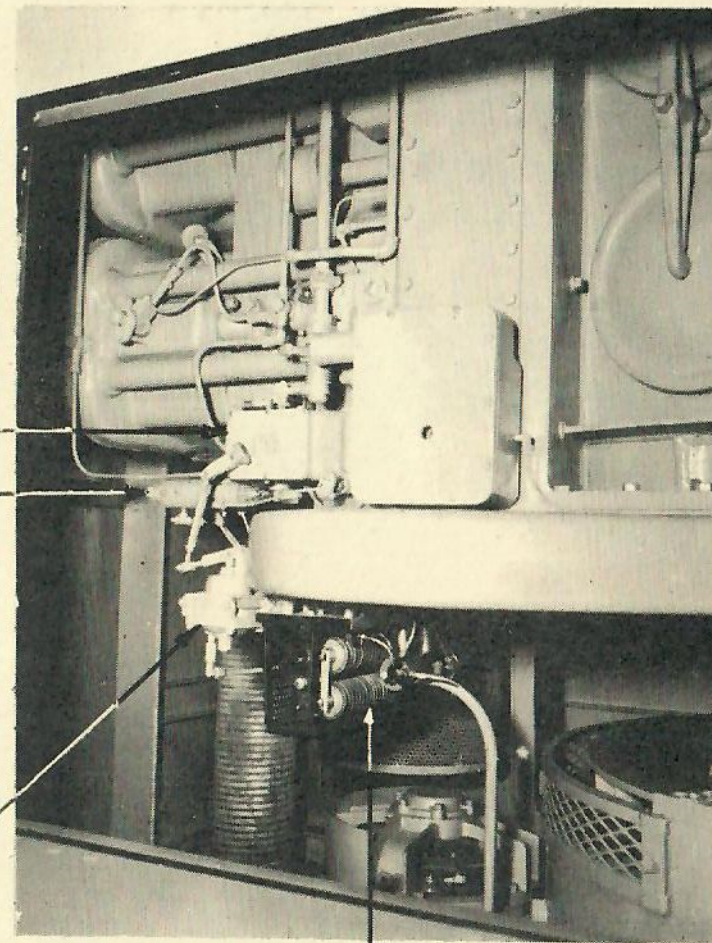
BATTERY SWITCH

BATTERY CHARGING FUSE

EQUIPMENT CABINET - LEFT SIDE

ACTUATOR

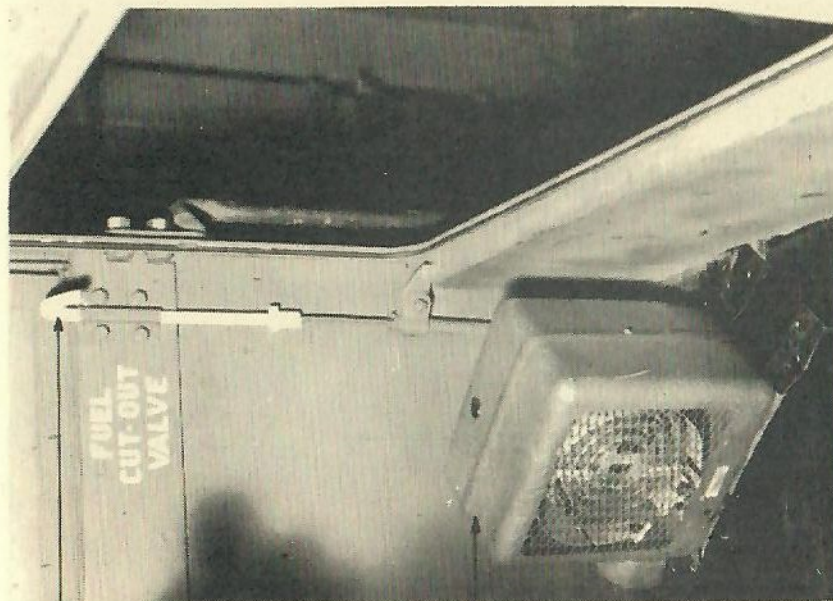
LOAD REGULATING VALVE
GOVERNOR



CARBONSTAT

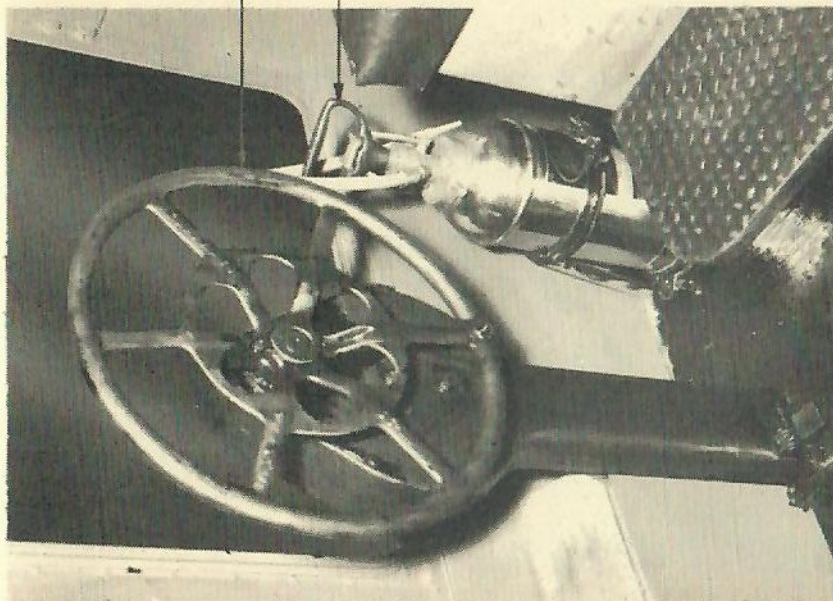
CARBONSTAT AND LOAD
REGULATING VALVE

EMERGENCY
FUEL CUTOUT
VALVE TRIP



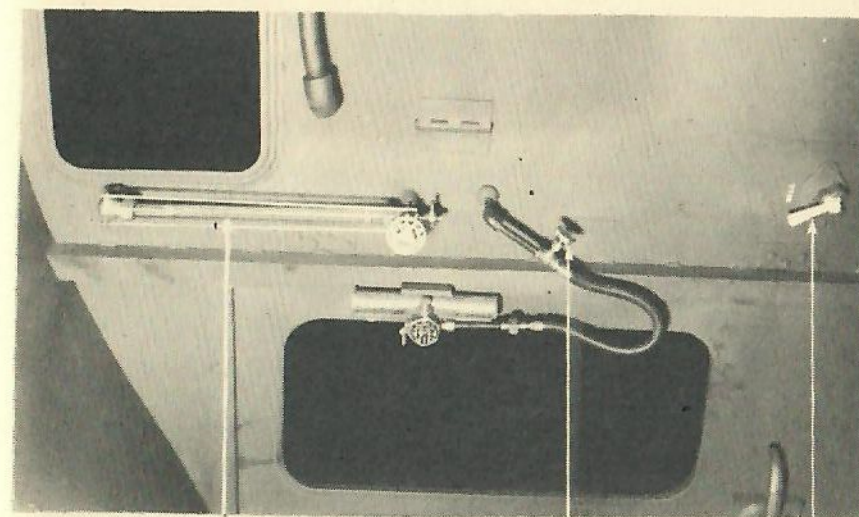
RIGHT

HAND BRAKE
FIRE
EXTINGUISHER



LEFT

CAB-REAR

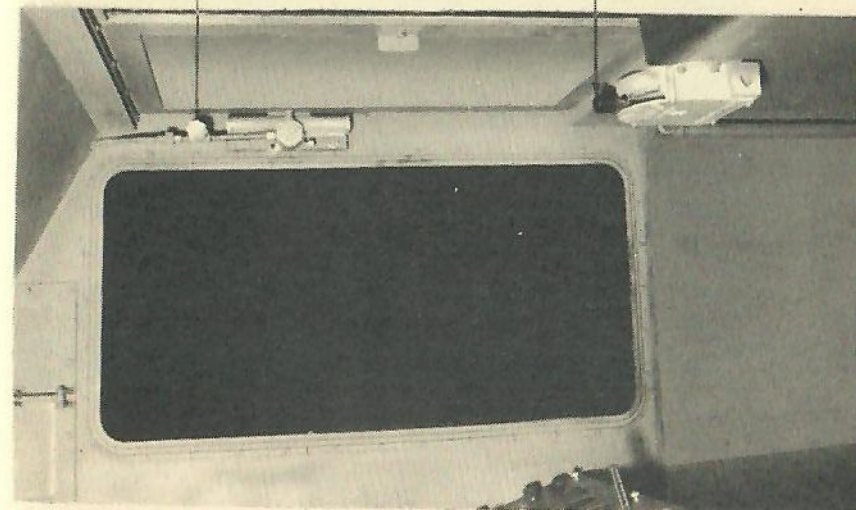


ENGINE COOLING
WATER TANK
GAUGE

WINDOW WIPER
VALVE

HELPER'S BELL
VALVE

LEFT

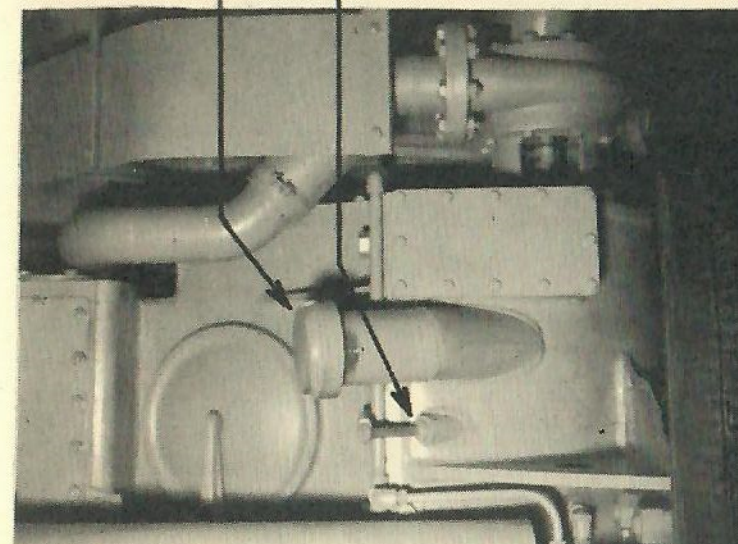
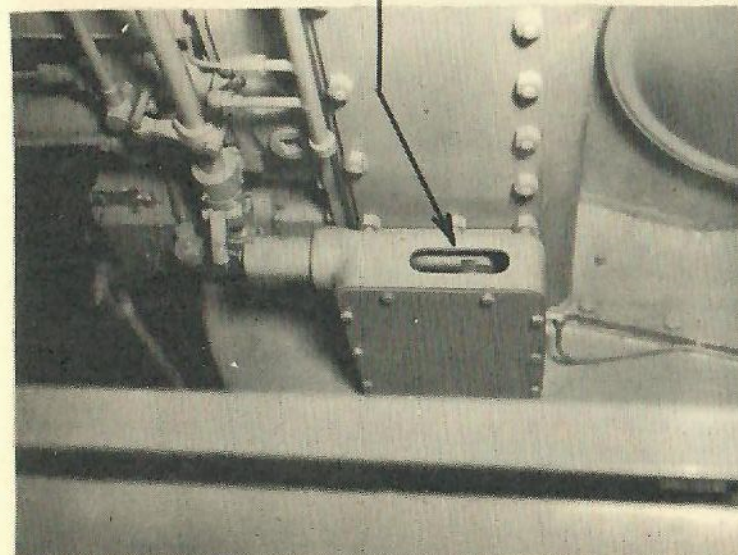


WINDOW WIPER
VALVE

HEADLIGHT
DIMMER
SWITCH

RIGHT

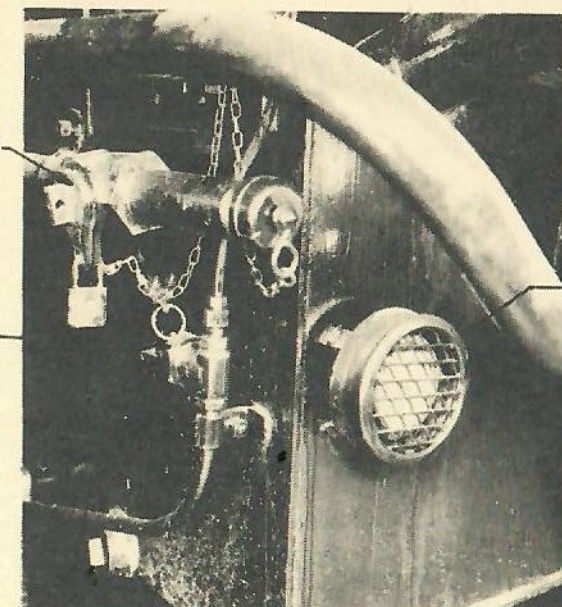
CAB - FRONT



DIESEL ENGINE - RIGHT SIDE

LUBRICATING
OIL DRAIN
VALVE

FUEL OIL
EMERGENCY
CUT OFF
VALVE

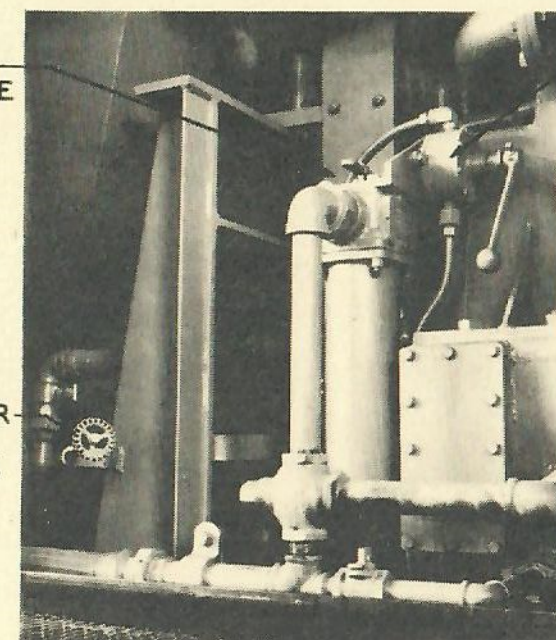


FUEL OIL
GAUGE

FUEL TANK - LEFT SIDE

LUBRICATING
OIL KNIFE EDGE
FILTER

COOLING WATER-
FILLING AND
DRAIN VALVE



LUBRICATING
OIL HAND PUMP

DIESEL ENGINE - LEFT SIDE

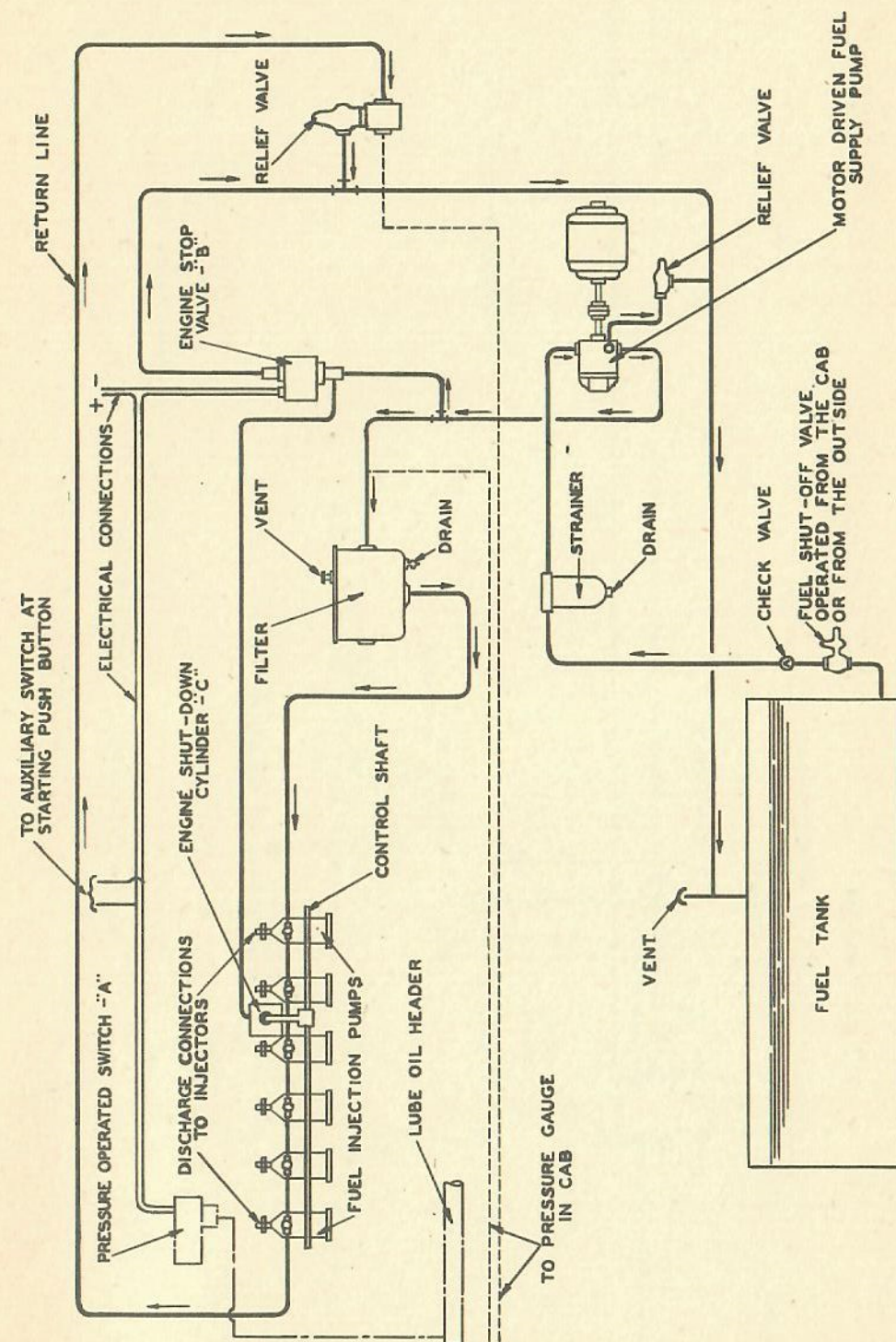


DIAGRAM OF FUEL OIL SYSTEM

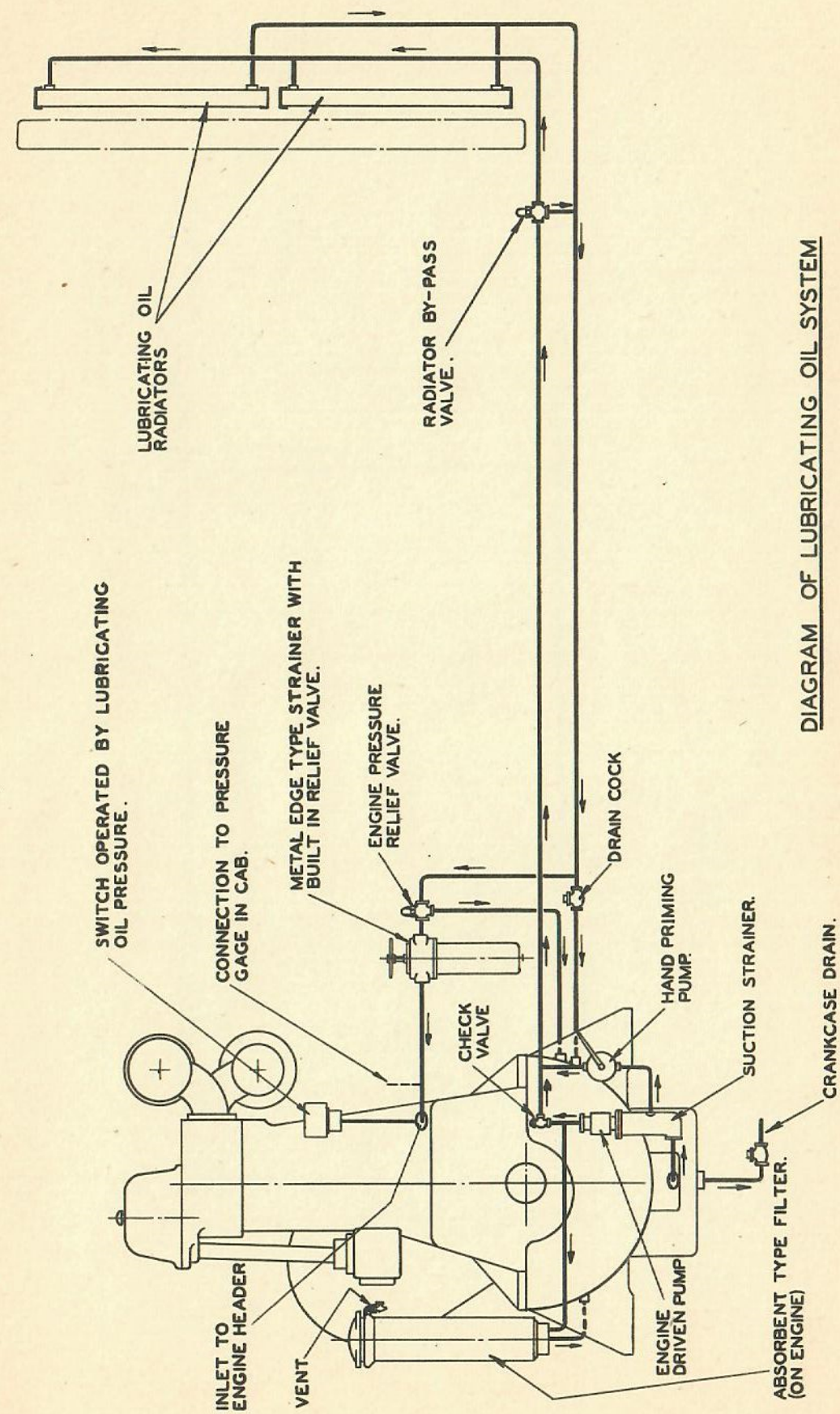


DIAGRAM OF LUBRICATING OIL SYSTEM

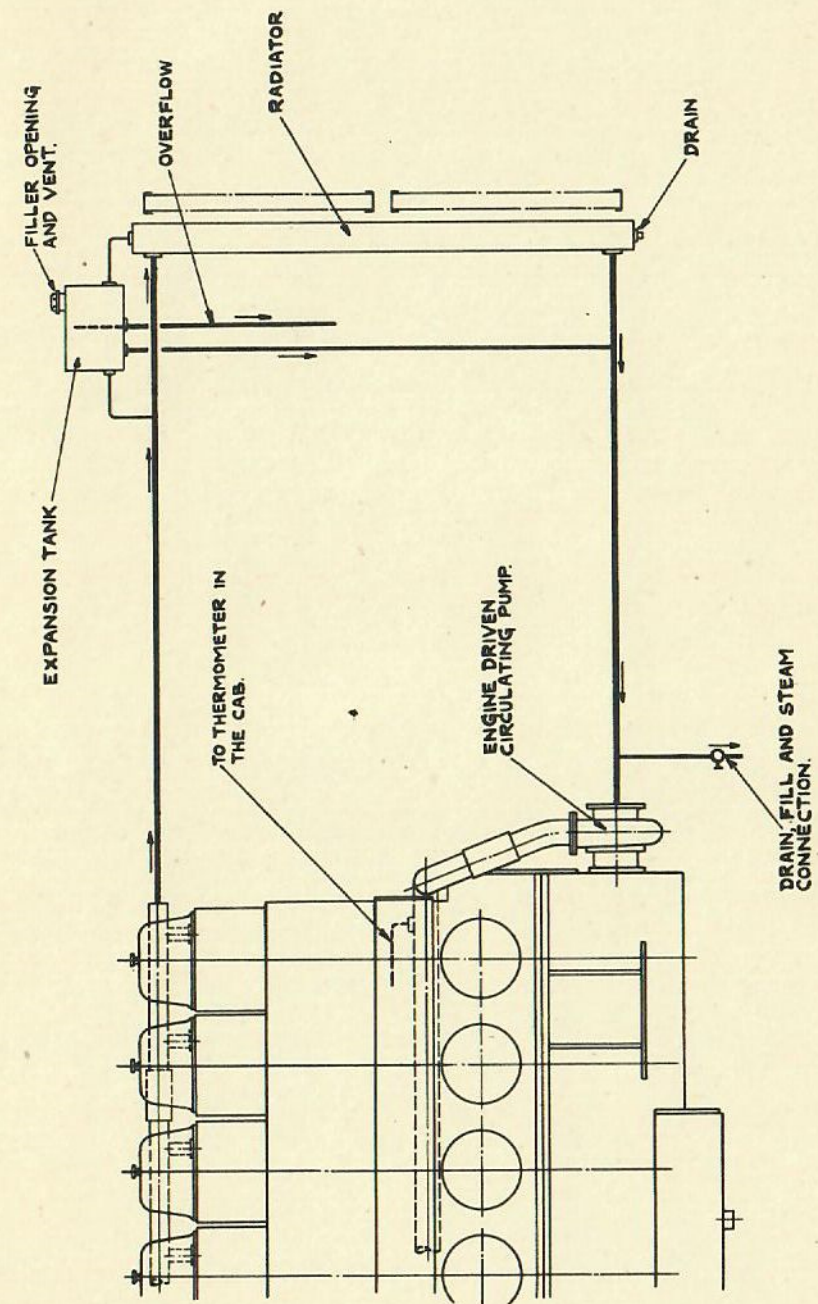


DIAGRAM OF ENGINE COOLING WATER SYSTEM

